28. A method as described in Claim 26 wherein the suspect is a likely perpetrator of a crime.

29. A method as described in Claim 20 wherein the optimization procedure includes a minimization step.

A4 cont

30. A method as described in Claim 20 wherein the optimization procedure includes an arithmetic operation.

REMARKS

Claims 17-30 are currently active. Claims 17, 19, 21 and 22 have been amended. Claims 23-30 have been added.

Antecedent Support

Antecedent support (claim 17) for "analyzing" a DNA mixture is found on page 69, first paragraph.

Antecedent support (claim 17) for representing "a genotype contained in the DNA mixture" is found on page 71, first paragraph.

Antecedent support (claims 17, 19, 21) for representing the problem as a set of "linear equations" is found on page 71, lines 14 and 25, and on page 72, lines 9-13.

Antecedent support (claim 17) for a "mathematical" solution is found on page 71, line 20.

Antecedent support (claim 17) for "determining" a genotype profile is found on page 70, lines 9-12.

Antecedent support (claim 21) for "performing a matrix operation" is found on page 80, line 1.

Antecedent support (claims 22, 23) for "estimating" parameters such as mixture proportions or genotypes is found on page 70, line 26, on page 72, line 9, and on page 74, line 6.

Antecedent support (claim 23) for a DNA mixture "proportion" is found on page 71, line 6.

Antecedent support (claim 23) for estimating a DNA mixture "weight" is found on page 74, line 6.

Antecedent support (claim 24) for assessing the solution "quality" is found on page 76, second paragraph.

Antecedent support (claim 25) for a "matrix multiplication of a genotype matrix and a weight matrix" is found on page 71, line 1. Note that a column vector is an nx1 matrix, and a row vector is a 1xm matrix.

Antecedent support (claim 26) for "matching" a genotype against a reference genotype is found on page 61, lines 24-26, and on page 77, lines 1-2.

Antecedent support (claim 27) for matching against a genotype "database" is found on page 62, lines 6-9.

Antecedent support (claim 28) for genotype profile matching in "crime" applications is found on page 62, lines 6-9.

Antecedent support (claim 29) for "minimization" in optimization procedures is found on page 76, line 8.

Antecedent support (claim 30) for "arithmetic" operations in optimization procedures is found on page 74, second paragraph.

Claim Traversal

Claims 1-16 have been cancelled.

Claim Rejections - 35 U.S.C. 112

Claims 17-22 were rejected under 35 U.S.C., second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as invention. This indefiniteness centered on the "resolving" of DNA mixtures, and the type of "resolution" employed.

In the amended claims, the "resolving" and "resolution" language has been removed, and now "analyzing" and "determining" language is used. In amended Claim 17, it is now clear that the method is analyzing a DNA mixture, and determining a genotype as part of the solution.

Applicant respectfully submits that this amendment fully addresses and adequately overcomes examiner's objections, and requests that the Claims 17-22 (as amended) now be allowed.

Claims 19-21 were rejected under 35 U.S.C., second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as invention. This indefiniteness had to do with reducing a matrix or vector to a linear equation.

In the amended claims, the "linear equation" language has been removed, and now the "set of linear equations" language is used. That mathematical matrices and vectors are equivalent representations to a set of "linear equations" is well known in the art of linear algebra, and has been fully described in introductory textbooks on the subject. See, for example, the undergraduate text: Beauregard R. A., and Fraleigh J. B. (1973). "A First Course in Linear Algebra," Houghton Mifflin Company, Boston.

Applicant respectfully submits that this amendment fully addresses and adequately overcomes examiner's objections, and requests that Claims 19 and 21 (as amended) now be allowed.

Claims 17-22 were rejected under 35 U.S.C., first paragraph, because of enablement issues with the linear equation and its solution. Examiner states that "the specification does not enable any person skilled in the art to which it pertains, or which it is most nearly connected, to deduce the invention commensurate in scope with these claims."

In the amended claims, the "linear equation" language has been replaced by the more descriptive "set of linear equations" language. These linear equations are mathematically equivalent to matrices and vectors, which are well-known in the art of Bioinformatics. The well-established field of Bioinformatics combines molecular biology applications, with mathematical and computational analysis methods.

A description of the invention that largely parallels the specification was recently published in the foremost peer-reviewed American forensic science journal (see: Perlin M. W., and Szabady B. (2001). Linear mixture analysis: a mathematical approach to resolving mixed DNA samples. Journal of Forensic Sciences 46: 1372-1377). The fact of this publication suggests that the reviewers, the editors and a number of readers who are skilled in the art of Forensics or Bioinformatics found sufficient enablement to deduce the invention commensurate in scope with these claims, which is why the invention warranted publication in a prestigious scientific journal.

Also, a description of the invention that largely parallels the specification was funded by the US Justice Department for validation studies (see: NIJ grant number 2001-IJ-CX-K003). Here again, this independent scientific review suggests that the grant application reviewers, the National Institute of Justice funding agency, and the collaborating researchers found sufficient enablement in the specification.

Moreover, the invention explicitly connects the linear response of the physical PCR experiment, with the linearity of the matrix (i.e., set of linear equations) solution, as on page 70, line 31 through page 71, line 6. This novel and nonobvious connection has its solution enabled in the invention by the appropriate linear mathematics provided throughout the

specification. The invention's connection between the linear PCR phenomenon and the linear mathematics has broad application, and is an entirely general approach.

The tutorial section in the specification (page 70, line 31, through page 73, line 4) shows in great detail how make and use the claimed invention. The data, genotypes and other parameters are clearly described in a general set of linear matrix equations. The specification shows how to set up these equations for any mixture data, and then provides mechanisms for their solution. The specification shows exactly what the equations are, and how they are solved. One skilled in the art of Bioinformatics can apply the claim language, in the context of the specification, to make and use the claimed invention for analyzing a DNA mixture.

Applicant respectfully submits that this amendment fully addresses and adequately overcomes examiner's objections, and requests that Claims 17-22 (as amended) now be allowed.

Claim Rejections - 35 U.S.C. 102

Claim 17 was rejected under 35 U.S.C. section 102 (b) as being anticipated by the Menchen et al or Grossman patents. These patents basically describe an electrophoretic method to resolve portions of DNA, as was claimed in the invention.

In the amended claims, all reference to "resolving" or "resolution" has been removed. Instead, the claims refer to a "method for analyzing a DNA mixture". The electrophoretic methods of Menchen et al or Grossman do not teach or suggest "analyzing a DNA mixture". Therefore, their techniques do not reside within the broadness of the amended claims.

Applicant respectfully submits that this amendment fully addresses and adequately overcomes examiner's objections, and requests that Claim 17 (as amended) now be allowed.

Title of Invention

The title has been changed to the more descriptive: "A Method for DNA Mixture Analysis".

Correction of Drawings

Corrected drawings with proper margins are enclosed. Formal drawings will be provided upon allowance.

In view of the foregoing amendments and remarks, it is respectfully requested that the outstanding rejections and objections to this application be reconsidered and withdrawn, and Claims 17-30 now in this application be allowed.

Respectfully submitted,

MARK W. PERLIN

By _____
Ansel M. Schwartz, Esquire
Reg. No. 30,587
201 N. Craig Street
Suite 304
Pittsburgh, PA 15213
(412) 621-9222

Attorney for Applicant

CERTIFICATE OF MAILING

I hereby certify that the correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Commissioner of Patents and Trademarks, Washington, DC 20231, on 2/21/01

Ansel M. Schwartz
Registration No. 30,587

2/21/01
Date

Version with markings to show changes made:

17. A method for [resolving] analyzing a DNA mixture[s] comprised of the steps:

(a) obtaining DNA profile data that include a mixed DNA sample;

(b) representing the data and a genotype contained in the DNA mixture in a set of linear equations;

(c) deriving a mathematical solution from the linear equations; and

(d) [resolving] determining the genotype from the solution.

19. A method as described in Claim 17 wherein the representing step (b) includes a matrix or vector representation of the set of linear equations.

21. A method as described in Claim 17 wherein the deriving step (c) includes performing a matrix operation on the linear equations.

22. A method as described in Claim 17 wherein the [resolving] determining step (d) produces an estimate of the genotype of an individual.